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# BioOptions

Newsletter of the Center for Alternative Plant and Animal Products Volume 2, Number 4 Fall 1991

Sponsored by the Agricultural Utilization Research Institute, the Minnesota Extension Service and the University of Minnesota Agricultural Experiment Station

## AAO Bibliography

The Center for Alternative Plant and Animal Products and the USDA Extension Service have developed a database of over 1600 publications on Alternative Agricultural Opportunities. Extension materials from across the U.S. and Canada have been compiled into an easily accessible and user friendly database. It is also available as a printed publication.

Types of materials in the database include: fact sheets, bulletins, research reports, proceedings, manuals, software, videotapes, and other materials that are not readily accessible. Topics covered include: agronomic crops, fruit and vegetable crops, ornamentals, aquaculture, livestock, forestry products, as well as information on marketing and economic feasibility.

Copies of the printed and electronic forms of the database are being sent to each state extension service director. Additional copies are available at a cost of \$5.00 for either version. Make checks payable to "University of Minnesota" and specify whether you want the printed or electronic version. Send to the Center for Alternative Plant and Animal Products at 340 Alderman Hall, Univ. of Minnesota, St. Paul, MN 55108. You must have a computer with a hard drive in order to use the electronic version.

## Milkweed: A New Fiber Crop

Lewrene K. Glaser  
USDA Economic Research Service

Two milkweed species, common milkweed (*Asclepias syriaca*) and showy milkweed (*Asclepias speciosa*), are being grown in Nebraska for their floss (3). The floss, the plants' natural method of seed dispersal, interests entrepreneurs and scientists for its uses in insulated clothing, nonwoven textiles, and tissue paper.

During World War II, milkweed floss was substituted for kapok in life jackets (2). In the 1970s, the Department of Energy, Standard Oil of Ohio, and other organizations conducted research to determine the potential of the plant's milky latex as an energy source. When the research was discontinued, Herbert Knudsen, who was involved with the project at Standard Oil, saw greater market potential for the floss than the latex. As a result, Natural Fibers Corporation was formed to study and commercialize milkweed floss.

Milkweed has been produced in Nebraska for 4 years as part of the company's experiments, with approximately 160 acres being grown in 1991. The plant is a perennial; commercial stands should last 5 to 10 years. About 20 inches of water are needed annually to maintain plant populations and promote pod formation (3). Preliminary research indicates that

floss yields respond to 80 pounds of nitrogen per acre.

Low yield is the major factor holding back the development of milkweed as a commercial crop. Yields in research plots during the last 5 years have averaged about 400 pounds of floss per acre, but those results have not been duplicated under field conditions.

Weeds, such as nightshade and foxtail, and diseases, such as black leaf spot and bacterial blight, have been major problems (1, 3). In 1990, the average commercial yield from the 160 acres was only 6 pounds of floss per acre, but that was double the 1989 average of 3 pounds (3). The best field produced 28 pounds per acre, almost triple the highest yield in 1989. Three of the six fields in 1990 had no yield at all. (Data for the 1991 harvest are not yet available).

The University of Nebraska has modified a self-propelled corn picker to harvest milkweed pods (1). The pods are harvested in August while they are green to prevent floss degradation and loss. After harvest, the pods are cracked open in a "conditioner" to expose the floss for drying.

(See *Milkweed* page 2)



### *(Milkweed from page 1)*

A two-step drying process reduces moisture from about 80 percent to about 10 percent. After drying, the floss is mechanically separated from pod shells, seeds, and other debris (3). About 500 pods are required to produce a pound of floss. The seed can be sold as livestock feed and the pod shells and plant stems contain bast fiber that could be used in high-quality papers.

Milkweed floss is a hollow fiber. It has about the same density as high-quality goose or duck down. Tests conducted at Kansas State University show that the floss is a better insulator than goose or duck down. The fibers are covered with a natural wax, making them water resistant. Also, because the fibers are made of cellulose, people should not experience allergic reactions to the floss. In laboratory and consumer tests, allergic responses have been negligible (2).

These characteristics, combined with the light weight of the floss, make it a good candidate for filler in comforters, sleeping bags, and insulated clothing (1). Natural Fibers Corporation is manufacturing comforters filled with a mixture of milkweed floss and goose down.

Textile experts at the University of Nebraska are examining the use of milkweed floss in nonwoven batting. A batt of 60 percent floss and 40 percent synthetic fiber has an insulative capacity comparable to Thinsulate and withstood dry cleaning just as well. Researchers are presently evaluating a batt containing 85 percent floss.

Natural Fibers Corporation, the University of Nebraska, USDA's Cooperative State Research Service, and four Nebraska farmers are working together to overcome

the barriers to milkweed production and product use. Short-term research priorities include:

- o improving yields through plant selection and disease control;
- o documenting floss characteristics--such as fiber length, fineness, and maturity--with techniques used by the cotton and wool industries; and
- o preventing fiber matting in loose-fill products (in items like comforters and jackets, 100-percent milkweed floss tends to mat together and form lumps with use and cleaning).

As yields and production increase, milkweed floss could be competitive in higher volume, lower value markets, such as textiles and high-quality papers. For example, adding floss to tissue paper makes it softer. In addition, milkweed floss absorbs 75 times its weight in liquid once the fibers are stripped of their wax (1, 2). Because of this property, possible uses include disposable diapers and other superabsorbent products.

#### Literature Cited:

1. Kessler, K. "Milking Profit From Milkweeds." The Furrow, September-October 1990, pp. 24-25.
2. Knudsen, H. "Milkweed Floss Fiber for Improving Nonwoven Products." Unpublished paper, Natural Fibers Corporation, Ogallala, NE, undated.
3. Milkweed Project Summary. Industrial Agricultural Products Center, University of Nebraska, November 1990.

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### BioOptions

is the quarterly newsletter of the Center for Alternative Plant and Animal Products at the University of Minnesota. The Center was created to aid in the development of new and alternative crop and livestock enterprises.

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# Advantages and Disadvantages of Specific Types of Markets

Reprinted from "Ag Opportunities", August-September, 1991

## Farmers Markets

- + Central location
- + Large volume of customers
- + Advertising and promotion done by organization
- + Lower overhead
- + Requires less marketing time
- + Better price control
- + Cash payment

- Must transport produce
- Do not have as much control over promotion
- Sell only when the market is open
- Must deal with all types of people

## Roadside Stands

- + Displays to draw customers
- + Variety of products to draw customers
- + Can be tailored to producer or customer's taste and preference
- + Can be expanded to meet the needs of the producer
- + Better price control
- + Cash payment

- Long hours
- Must deal with all types of people
- Must get customers to produce
- Liability insurance
- Expense of sales location

## Pick-Your-Own

- + Harvest labor reduced
- + Grading, packing and storage eliminated
- + Container cost reduced
- + Cash payment
- + Yields can be higher
- + Better price control

- Liability insurance
- Longer hours
- Must deal with all kinds of people
- Must get customers to produce

## Wholesale

- + Wholesale buyer assumes the market risk
- + Price agreed to at time of sale and current
- + Quality product usually receives a better price

- Must be graded and packed
- Lower profit margin
- Large volume

## Brokers

- + Larger number of buyers are exposed to seller's product
- + Prices are current
- + Quality product usually receives a better price

- Must be graded and packed
- Grower retains responsibility for quality until delivery
- Large volume
- Lower profit margin

## Processor

- + Production assistance
- + Production inputs may be supplied
- + Harvesting assistance
- + Known price
- + Known production amount

- Not many in area
- Large volume
- Must meet contract schedule
- Lower profit margin

## Contract

- + Known price
- + Known quantity
- + Known market
- + Collateral for loans

- Grower must be able to supply quantity and quality at the agreed time
- Lower profit margin



## Publications

### Specialty and Minor Crops

**Handbook** is a new publication from the Small Farm Center at the University of California. The handbook is a series of 36 factsheets with color photographs in a looseleaf binder. Each sheet contains information on seed sources, cultivation and production methods, and marketing alternatives. Some of the crops included are: baby corn, bok choy, cardoon, daikon, fennel, jicama, okra, radicchio, and wax gourd. To order, mention the title and publication number 3346, make a check for \$30.00 payable to "UC Regents" and send to UC Small Farm Center, University of California, Davis, CA 95616-8699.

**Transition Toward a Sustainable Agriculture**, Special Reference Brief 91-04, has been developed by the Alternative Farming Systems Information Center at the National Agricultural Library. They also produce a series of bibliographies on topics relating to sustainable agriculture and alternative crops, including: **Agroforestry Systems** (QB 90-27), **Alternative Crops** (QB 90-25), **Amaranths for Food or Feed** (QB 90-29), **Forage Legumes** (QB 90-76), **Rotational Grazing and Intensive Pasture Management** (QB 90-03), **Raising Quail, Pheasants, Partridge, Bobwhites, and Ostriches** (QB 91-72). One copy of each title requested is provided at no charge. To order, send a self-addressed, gummed label along with the name and number of the publications desired to: Alternative Farming Systems Information Center, National Agricultural Library, Room 111, 10301 Baltimore Blvd., Beltsville, MD 20705-2351.

**Marketing of Floricultural Products in the United States, An Annotated Bibliography** is another useful publication from the National Agricultural Library. It is a comprehensive list of journals, newsletters, books, bibliographies, and other government reports on marketing as well as titles of

associations and organizations, and addresses for the national market price reports. Mention "Bibliographies and Literature of Agriculture, Number 66" in addition to the title. The address is National Agricultural Library, 10301 Baltimore Blvd, Beltsville, MD 20705.

**The Commercial Storage of Fruits, Vegetables and Florist and Nursery Stocks**, Ag Handbook 66, gives clear and concise descriptions of temperature and relative humidity requirements for best shelf life. It is available at a cost of \$7.00 from: U.S. Government Printing Office, 1305 SW 1st, Portland, OR 97201.

**Managing Global Genetic Resources** is the title of a series of publications by the Board on Agriculture of the National Research Council. Two of these reports, **The U.S. National Plant Germplasm System** (\$19.95) and **Forest Trees** (\$24.95) are now available. Prices do not include shipping and handling which is a flat \$3.00 per prepaid order. Future publications will include: **Livestock, Fish and Shellfish, and Agricultural Crop Issues and Policies**. For further information, contact: National Academy Press, 2101 Constitution Avenue, Washington, DC 20418.

**Microlivestock** is another new publication from the National Research Council. It contains information on 35 little-known small animal species with a promising economic future, especially in developing countries. Species mentioned include: quail, rabbit, mouse deer, agouti, green iguana, as well as small breeds of common livestock. Each chapter describes the characteristics of the species, its uses, and the potential and limitations of the species. It was not designed to be a "how to" manual but rather as a guide for administrators, researchers, and others involved with development issues. The cost is \$29.95 plus \$3.00 shipping and handling. Make

checks payable to National Academy Press, P.O. Box 285, Washington, DC 20055.

**How to Succeed in Fallow Deer Farming** is a new book developed under the auspices of the Heartland Venison Producers Cooperative. It covers all aspects of a deer farming operation including management, herd health, and marketing. For more information, contact Heartland Venison, 509 South Second, Maquoketa, IA 52060 or call (319) 652-2035.

**Washington Insight** is a "newsletter for natural products scientists" that focuses on legislation and research relating to medicinal plants. It is published quarterly and subscription costs in the U.S. are \$35 personal and \$75 institutional (add \$10 for foreign orders). For further information contact: Washington Insight, 11000 Waycroft Way, North Bethesda, MD 20852.

**Setting Priorities: Research, Practice, and Policy for a More Sustainable Agriculture** is the title of the proceedings of the 1991 Conference of the Leopold Center for Sustainable Agriculture. The cost is \$5.00, including postage. Make checks payable to "Iowa State University" and mail to: Leopold Center for Sustainable Agriculture, 126 Soil Tilth Building, Iowa State University, Ames, IA 50011-3120.

**American Journal of Alternative Agriculture** is a peer reviewed journal in the area of sustainable agriculture. It is probably the most evenhanded, credible publication on the topic. It is published quarterly. A newsletter, **Alternative Agriculture News** is published monthly. The yearly subscription cost for both publications is currently \$30.00. For more information, contact: Institute for Alternative Agriculture, Inc., 9200 Edmonston Road, Suite 117, Greenbelt, MD 20770-1551 or call (301) 441-8777.

(See *Publications*, page 5)

**(Publications from page 4)**

**Wisconsin Pastures for Profit: A Hands-On Guide to Rotational Grazing** is a new 52 page publication from the University of Wisconsin. It provides clear instructions to anyone hoping to start or improve a rotational grazing program. To order, specify title and booklet A3529. Send check for \$1.25, payable to University of Wisconsin at Madison, to: Agricultural Bulletin, Room 245, 30 N. Murray St., Madison, WI 53715.

**Harvest of Hope: The Potential for Alternative Agriculture to Reduce Pesticide Use** is a recent publication from the National Resources Defense Council. This 124-page report is available for \$19.95, including postage. Contact: National Resources Defense Council, 71 Stevenson Street, San Francisco, CA 94105.

**Chile Pepper** is a magazine dealing with the latest trends in spicy foods. A recent article was on the history and manufacture of pepper beers. It is published six times per year and costs \$15.95. Contact: Out West Publishing, P.O. Box 4278, Albuquerque, NM 87196.

**American Ginseng Trends** is a newsletter that has been published since 1989. For further information, contact: Future Concepts, Inc., P.O. Box 1982, Wausau, WI 54402-1982.

**Herb Gardens in America - A Visitors Guide**, by Karen S. C. Morris and Lyle E. Craker, includes information on essentially all the herb gardens in America that are open to the public. Information is arranged by state. This book also includes an appendix on how to start your own herb garden and line drawings of various herbs interspersed throughout the text. Retail price is \$9.95, quantity discounts are available. Contact: HSMP Press, 176 Heatherstone Road, Amherst, MA 01002.

**(News Briefs from page 6)**

emphasis that have been identified include: cereal crop value-added processing, new livestock and meat processing, and oil crop processing. For further information contact: NRAUC Administrative Office, c/o AURI, 530 Fisher Ave., Crookston, MN 56716.

**Japanese grown Wagyu beef tops taste test** (Rural Enterprise, Vol. 5, No. 4). During the Washington State University Beef Information Days, U.S. cattle producers participated in a blind taste test. They rated Japanese-grown Wagyu beef first, Washington-grown Wagyu second, Angus third, and a selection of choice grade New York strip steak from a local packing plant fourth. All the meat was flame broiled and rated on tenderness, juiciness and flavor.

**Ethnic crop production: An overview and implications for Missouri** discussed the potential of specialty vegetables for Missouri farmers (HortScience, Vol. 26 (9)). The large number of immigrants from Asia, the Caribbean and Latin America and increasing appreciation for ethnic foods among many Americans has increased demand for specialty vegetables such as calabaza, scotch bonnet pepper, yam, bitter leaf, kiwano, amaranth, and pigeon pea. The 1988 specialty vegetable import statistics (USDA Economic Research Service) indicated a 12% average increase from 1987. Researchers at Lincoln University are investigating the market potential of ethnic crops in the Midwest, cultural practices for ethnic crops, and economic information on ethnic crop production.

**Corn Crop Sprouts New Industrial Uses** such as biodegradable alternatives to plastic eating utensils (Omaha World-Herald, July 1, 1991). Non-food uses of corn have risen from 220 million bushels in 1980 to 575 million bushels in 1990. The National Corn Growers Assn. estimates that each time a new use is found for 100 million bushels of corn, the value of the entire crop rises a nickel a bushel. The demand

for corn for ethanol production was 380 million bushels in 1990. Ethanol-blended gasoline not only helps reduce reliance on imported oil, it also reduces harmful emissions. A non-hazardous, peanut shaped loose fill has been developed that is 95% corn starch and 5% polyvinyl alcohol. Eco-Foam costs twice as much as the styrene packaging but holds 14% of the market. If it replaced all of the polystyrene material, it would create a new market for 3-4 million bushels of corn per year.

**National Agriculture Library participates in new sustainable agriculture network** of 14 universities, government agencies, businesses and non-profit organizations. The network is funded through a grant from the USDA Sustainable Agriculture Research and Education program, formerly known as the Low-input Sustainable Agriculture program. The network will facilitate sharing of information about sustainable agriculture among many information users and providers. More and more information on sustainable agriculture is available from research and educational institutions, private non-profit groups, farmer organizations and others, but locating the information and identifying the gaps is an increasing challenge. The directory will identify experts and other sources of information on sustainable agriculture and will be available in printed and electronic form.

**The American Minor Breeds Conservancy** is a relatively new non-profit organization that educates the public about the importance of minor breeds and the genetic diversity they represent. They serve as a clearinghouse of information about minor breeds, their characteristics, status, and who is raising them. They operate a semen bank for rare breeds of cattle and other species and provide technical support to breed associations. For further information, contact American Minor Breeds Conservancy, P.O. Box 477, Pittsboro, NC 27312.



## News Briefs

**The cultivation and harvest of paprikas (*Capsicum annuum*)** was described in a recent issue of the "Herb Market Report" (Vol. 7, No. 3). Columbus did not find the spices of the Orient as he had hoped, but he did find chilies or *Capsicum*, which is America's most important contribution to the spice trade. The spice soon spread throughout the tropics and warm temperate regions of the Old World. *Capsicum* is also known as chili, paprika, pimento, and sweet, red, cayenne, or bird pepper depending on the type and the way it is used. Sweet peppers, also known as green or bell peppers, have the mildest flavor and are often used as a vegetable. Paprika, which may be sweet or mildly pungent, is grown mainly in southern Europe. The dried fruits are finely ground. The brilliant red powder is used as a flavoring and garnish. Chilies are the dried ripe fruits of the pungent forms. One of the more pungent forms is *C. frutescens*, or bird chilies. This is the species cultivated in Louisiana for 'Tabasco'.

**Release of 'Plainsman' grain amaranth** was announced in "Legacy", the official newsletter of the Amaranth Institute (Vol. 4, No. 1). Plainsman was developed cooperatively by the Rodale Research Center and the Nebraska Agricultural Experiment Station. It originated from a cross between a *Amaranthus hypochondriacus* accession from Mexico and a *A. hybridus* accession from Pakistan. Plainsman is widely adapted and has been grown successfully from North Dakota to Missouri. It has been evaluated in amaranth variety trials and in farmers' fields in the Great Plains from 1986-1990. Yields have averaged more than 600 kg/ha. Breeder seed will be maintained by the University of Nebraska Agricultural Research Station, Panhandle Research and Extension Center.

**A biological herbicide** is being developed by University of

Minnesota researchers. Subspecies of *Brassica campestris* were crossed to produce a "smother" plant that grows very fast, develops dense vegetation that smothers weeds before they have a chance to compete with the crop, and then, after 4-6 weeks, completes its life cycle and dies. In addition to controlling weeds without the use of chemical herbicides, use of the smother crop would also reduce soil erosion. Weed scientist Don Wyse cautions that it will take several more years of research before growers will be able to buy seed commercially.

**Pheromones could replace half of vineyard insecticides** according to researchers from Cornell University (Rural Enterprise, Vol. 5, No. 3). The grape berry moth is the most serious insect pest in grapes grown east of the Rocky Mountains and is currently the target of 100 tons of chemical pesticides in New York alone. The pheromone, a synthetic version of the natural sex attractant produced by the female, is released into the orchard confusing the male moths and effectively preventing them from finding females and mating. The pheromone has received government approval and will soon be used commercially.

**Little-known spelt may be tomorrow's trendy food grain** (Rural Enterprise, Vol. 5, No. 3). Spelt, widely grown in Europe, tolerates poorly drained, low-fertility soils. It can be used for flour, pasta, bread, muffins, and breakfast cereals and does not trigger the allergic reaction caused by wheat. In Germany, spelt sells for three times the price of common wheat. Ohio is the leading producer of spelt, growing 100,000 - 200,000 acres annually. Ohio has recently reinstated its spelt breeding program, the only one in the country.

**Sniffing out beneficial truffles in Georgia pecan orchards** could provide additional cash income (Rural Enterprise, Vol. 5, No. 3). A University of Georgia plant

pathologist accidentally found some strange brown objects after he kicked up some dirt in a pecan orchard. They were identified as truffles, although they are a different species from the ones from France and Italy which are found near the roots of oak trees. The truffles were evaluated by chefs who indicated that they were pleased with them although they were not as pungent as the European version. The truffles have been found in most of the pecan orchards in Georgia. The truffles are beneficial to the pecan trees, helping them absorb nutrients. Research may provide ways to increase their production and make them a viable second crop for Georgia's pecan growers.

**The New Uses Council** has elected Alan T. Tracy, Wisconsin Secretary of Agriculture, Trade and Consumer Protection as its new chairman. The New Uses Council is dedicated to expanding the use of industrial materials from renewable agricultural and forestry product resources. Its major emphasis is to create public-private sector partnerships to develop new programs and products using starches, oilseeds, fibers, animal co-products and specialty crops. For further information, write to the New Uses Council, 112 W. 6th Street, Suite 408, Topeka, Kansas 66603.

**Northern Regional Agricultural Utilization Consortium** was formed by the governors of Minnesota, and North and South Dakota. All three states produce commodities that are exported out of the states virtually intact. The organization's goals are: the development of value-added technologies through research into new uses and new products for northern-region commodities, transfer of that technology to regional industries through applied and pilot-scale research and demonstration, and creation of a venture capital fund for investment in new technologies. Areas of value-added research  
(See News Briefs, page 5)



## Calendar of Events

**November 10-13, 1991 - International Conference on Agriculture and the Environment** Columbus, Ohio. Issues addressed at the conference will include: global aspects of agriculture and the environment, integrated pest management, food safety, sustainable agriculture, and water quality. For further information contact Dr. Clive Edwards c/o Pat Gardner, Dept. of Conferences and Institutes, Int'l Conference on Agriculture and the Environment, Ohio State University, P.O. Box 2859, Columbus, OH 43216-2859.

**November 22-23, 1991 - Adapt 3: One More Chance to Diversify** Des Moines, Iowa. Sponsored by Successful Farming. For more info, contact Adapt 3, Successful Farming Editorial, 1716 Locust, Des Moines, IA 50309-3023.

**November 25-27, 1991 - First European Symposium on Industrial Crops and Products**

Maastricht, The Netherlands. For further information, contact Ms. Gerda v. der Linden, Secretariat Industrial Crops Symposium, Bernhardstraat 33, NL-7491 EA Delden, THE NETHERLANDS; Phone and Fax: +31 (05407) 63716.

**December 3-4, 1991 - Thrive Not Just Survive: Rural and Agricultural Profit Opportunities in the 90's** Madison, Wisconsin. It is sponsored by the Wisconsin Dept. of Agriculture, Trade and Consumer Protection (DATCP) and other organizations. Contact Pam Raschein, DATCP Marketing Division, (608) 266-9588.

**December 12-13, 1991 - New Crops for Europe** London, England. Organized by the International Centre for Underutilized Crops. For more information, write Dr. N. Haq, ICUC, Wyesplan Bldg., Wye College, Wye, Ashford, Kent TN25 5AH, U.K.

**January 10-11, 1992 - North American Bramble Growers Assn. Conference** Brooklyn Park, Minnesota. Contact NABGA, 2124 University Ave., St. Paul, MN 55114-1838.

**January 28-30, 1992 - 25th Great Lakes Vegetable Growers Annual Convention** Grand Rapids, Michigan. For further information, contact Tom Stebbins, Michigan State University; (517) 353-3774.

**January 30 - February 1, 1992 - 7th National Farmers' Direct Marketing Assn. Annual Conference** St. Paul, Minnesota. Co-sponsors include the Extension Services and Departments of Agriculture from Minnesota, Wisconsin, Iowa, and North and South Dakota. For more information, contact Joan Sigmundik, Ramsey Co. Extension Office, 2020 White Bear Ave., St. Paul, MN 55109; (612) 777-8156.  
*(See Calendar page 8)*

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Your comments about "BioOptions" would be most helpful to us. Please tell us what you like about our newsletter and how we could improve it. We also encourage you to send us information on upcoming events and new publications.



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**February 9-12, 1992 - North American Strawberry Growers Assn. Annual Meeting** Colonial Williamsburg, Virginia. Contact Ed and Betty Burns, Executive Secretaries, P.O. Box 1245 Tarpon Springs, FL 34688; (813) 937-4109.

**February 18-19, 1992 - Leopold Center Annual Conference** Ames, Iowa. For more information, contact the Leopold Center for Sustainable Agriculture, 126 Soil Tilth Bldg., Iowa State Univ., Ames, IA 50011.

**March 8-12, 1992 - International Conference on Development of New Crops** Jerusalem, Israel. For more information, contact Conference Secretariat, ORTRA LTD., P.O. Box 50432, Tel Aviv 61500, ISRAEL; Fax: 972-3-660952.

**March 15-19, 1992 - Second International Symposium on Specialty and Exotic Vegetable Crops** Miami, Florida. Sponsored by the International Society for Horticultural Science. For further

information, contact Office of Conferences, Univ. of Florida, 551 IFAS, Gainesville, FL 32611-0551.

**April 12-16, 1992 - Second International Food Legume Research Conference** Cairo, Egypt. Contact Dr. A.E. Slinkard, Crop Development Centre, University of Saskatchewan, Saskatoon, Sask. S7N 0W0 Canada; Phone: (306) 966-4978, Fax: (306) 343-1025.

**May 17-20, 1992 - Fourth North American Symposium on Society and Resource Management** Madison, Wisconsin. The symposium will focus on the integration of social and biological sciences as they together address natural resource and environmental issues. Abstracts for poster or papers are due Dec. 1, 1991. For further information contact Donald R. Field, School of Natural Resources, 1450 Linden Drive, Madison, WI 53706; (608) 262-6968.

**July 14-22, 1992 - International Crop Science Congress** Ames, Iowa. Program topics include: Striving for

a Productive and Sustainable Agriculture, Environmental Change: Challenges for Agronomists, Biodiversity, Crop Improvement Beyond the 1990's, and Advances in Physiology and Molecular Biology of Crop Plants. For further information, contact Dr. Kenneth J. Frey, Dept. of Agronomy, Iowa State University, Ames, IA 50011-1010; (505) 294-7607, Fax (515) 294-3163.

**July 30 - August 1, 1992 - Participatory On-farm Research and Education for Agricultural Sustainability** Champaign, Illinois. For further information, contact: Dr. John M. Gerber, UI Agricultural Experiment Station, 211 Mumford Hall, 1301 W. Gregory Dr., Urbana, IL 61801.

**September 8-10, 1992 - International Sunflower Conference** Pisa, Italy. For more information or to submit a paper, contact Conference Secretariat, c/o Istituto di Agronomia, Via S. Michele, 2, 56100-Pisa ITALY; Phone 050-571565, Fax 050-540633.

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